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I.—Notes on the Recent Literature of Japanese Land-Snails. By Dr. Henry A. Pilsbry, Special Curator of the Department of Mollusca, Academy of Natural Sciences of Philadelphia.

AFTER a period of twenty years, during which but little was published upon the land-mollusks of Japan, their investigation has been resumed by several students with the greatest vigour. This revival has been due primarily to the work of collecting undertaken by Mr. Y. Hirase, of Kyoto, Japan. With assistants trained in the best methods of collecting all parts of the Island Empire are being searched for mollusks. The direction of this work involves not only an intelligent appreciation of the zoological problems awaiting solution and of the value of such work in advancing the intellectual development of Japan, but large pecuniary outlay as well. And disinterested devotion to zoological exploration, though happily no longer rare in England and America, is not yet common enough to be passed without a word of appreciation.

It is my purpose in this article to discuss briefly certain Ann. & Mag. N. Hist. Ser. 7. Vol. viii.

questions of distribution and classification, to give a list of the species described since the beginning of the year 1900, and to record the somewhat extensive synonymy created

during that period.

The work has already reached a point where conclusions of general interest are appearing. The Palæarctic element in the Japanese mollusk-fauna is inconsiderable, but the Oriental element has obviously reached the islands by two routesa northern, viâ Sachalin Island, bringing in mainland forms of the Amur valley and northward, and a southern, via the Loochoo chain and Formosa, and probably from Corea also, though until that peninsula is better known we cannot state Thus, to give one instance, the this with confidence. Japanese group of species commonly referred to the Helicid subgenus Acusta is in reality of dual origin: the species of Hondo and Kiushiu (E. Sieboldiana, Pfr., E. plicosa, Martens \*) are related through Eulota despecta of the Loochoo group to E. assimilis, H. Ad., of Formosa, and to species of Central China. Eulota læta, Gld., of Hokkaido (Yesso) Island, on the other hand, is allied to species of Northern China and the Amur valley, and really belongs to the subgenus Mastig-A similarly dual origin can be traced in various other genera.

The great number of localities explored by Mr. Hirase's collectors permits us now to plot the ranges of many species before known from one locality or from but few places. As the work goes on this will enable us to formulate the lines of migration and the faunal zones or areas of specific and subspecific differentiation. It is already clear that the islands composing Japan are strikingly unlike most island groups in this-that the several islands, as such, are younger than the species of snails living upon them, whereas in most island groups areas of specific and varietal differentiation coincide with the geographic limits of the several islands. In other words, the existing species of Japanese snails were in great part differentiated and acquired their present distribution Present knowledge before the islands were separated +. indicates that continuous land extended from the middle Loochoo group to Hokkaido. The Loochoos were first isolated by subsidence; then Hokkaido was cut off.

<sup>\*</sup> H. plicosa seems to be merely a synonym of despecta, Gray, which occurs in the southern provinces of Kiushiu, as well as in the Loochoo slands.

<sup>†</sup> The evidence, so far as supplied by Helices of the *Euhadra* and *Ganesella* groups is concerned, has been elaborated in a still unpublished paper by Mr. Addison Gulick and myself.

Shikoku, and Kiushiu remained connected until very recent time, and have been separated within the life of those slightly differentiated races which we term "subspecies." From southern Kii, through Awaji and Shikoku Islands, across Bungo Channel to Kiushiu, and westward across the lower end of the Inland Sea to the west end of Hondo, must have been a continuous land-area since Pliocene and down to geologically recent time. Not only numerous species, but mere races of more widely spread species, occupy this area, and such a distribution is quite inexplicable except upon the theory that the areas in question, though now separated, were until recently a unit geographically, as they still are faunally. There are doubtless species existing on Shikoku Island which do not extend beyond its limits; but the local differentiation is not greater than upon an equal area of Hondo and does

not make against the view just set forth.

In respect to classification and generic nomenclature, the Japanese Zonitidæ are in great confusion. Reinhardt, many years ago, referred the species known to him to European groups of the family. Early last year I recognized the fact that the Japanese Zonitidæ belong mainly to Oriental, not European genera. This opinion found expression in articles published in August (vi. p. 382) and November (xv. p. 81), in which I referred various species to the Oriental genera Macrochlamys and Kaliella, showed that the name Euconulus, Reinh., must replace the names Conulus and Arnouldia, and expressed my belief that the Japanese species referred to these groups really belong to Kaliella. Dr. v. Möllendorff, in an article just published (XXI. pp. 35, 37), has reached conclusions in part anticipated by my papers, in part at variance with them. He has referred numerous species to the genus Microcystina of Mörch, most of them, I think, incorrectly. The establishment of Microcystina upon an adequate basis we owe to Godwin-Austen, who showed that it is characterized by a callous thickening or flexure of the columella. Of the Japanese species known to me by specimens, only Arnouldia ceratodes, Gude, has this feature. I consider v. Möllendorff's reference of this species to Microcystina justified. The species Dænitzi, sinapidium, and Hirasei of his Microcystina list have the shell-characters of cystina justified. Macrochlamys, and not of Microcystina. Most of the other species he mentions are known to me, as they are to him, by the descriptions only, and their generic reference is little better than guesswork.

Gastrodontella, Möllendorff, a new genus proposed for G. japonica, Mlldff. (1901), a synonym of Kaliella multi-

volvis, Pils. (1900), is thought by Dr. v. Möllendorff to have affinities with Gastrodonta or Sesara. The internal teeth in K. japonica are short transverse barriers at intervals of one third of a whorl, precisely similar to those found in Euconulus fulvus (Drap.), var. dentatus (Sterki), with which K. multivolvis has many features in common. A similar barrier exists in Kaliella ruga, Godwin-Austen, and some other Indian species. In K. multivolvis the barriers are very inconstant, completely lacking in some examples, varying in others from one to three in number. The same inconstancy attends the development of internal teeth, barriers, or laminæ in Gastrodonta, Sagda, &c., in which the same species may have them strongly developed or totally absent, as is well recognized by all American students who have investigated the matter. In my opinion, therefore, Gastrodontella has no valid claim to

generic rank. It belongs to Kaliella.

It is not my purpose to discuss the classification of Japanese Helicidæ at any length in this place; but a single group calls for remark. In my 'Guide to the Study of Helices' I proposed, under the name Mandarina, a new section of the genus Eulota for the reception of Helix mandarina, Gray, of the Bonin Islands (Ogasawara-sima). It is now my opinion that this group has nothing to do with *Eulota*, but probably belongs to the Camenine. The nepionic shell is relatively large and acutely carinate (as in Camana), is sculptured with fine radial wrinkles at first, with spiral striæ on the outer whorl, and usually continuing upon the postnepionic whorls. The adult shell is extremely heavy for a land-snail, and has a blunt expanded lip. The group is probably of generic rank, and will for the present include three species—Helix mandarina, Gray, H. Pallasiana, Pfr. (hitherto referred to Oxytes), and Nanina Ruschenbergeri, Pilsbry. The latter two are depressed and openly umbilicate, and will form a separate section of the genus Boninia. All of them are probably confined to the Bonin Islands, although they have been attributed to various localities. The Bonin Islands have incontestably a fauna of "continental" type.

The new species described from Japan, the Loochoo and Bonin Islands, in the twenty-two papers published since Jan. 1, 1900, are as follows. I have appended to each, where necessary, notes on the synonymy &c. The list is arranged chronologically, and the papers are referred to by their

numbers in the bibliography following.

Diplommatina tenuiplica, Pilsbry (t. p. 525). Ennea iwakawa, Pilsbry (t. p. 525, pl. xxi. fig. 10). Eulota (Acusta) Gainesi, Pilsbry (1. p. 526).—Belongs to the section Mastigeulata.

—— luna, Pilsbry (r. p. 526, pl. xxi figs. 1-3).

—— (Ægista) aperta, Pilsbry (1. p. 527, pl. xxi. figs. 7-9).

—— (Cælorus) cavicollis, Pilsbry (1. p. 527, pl. xxi. figs. 11-13). —— rudis, Pilsbry (1. p. 528, pl. xxi. figs. 20-22).—A synonym of Trishoplita Hilgendorfi, Kob.

Ganesella satsuma, Pilsbry (1. p. 528, pl. xxi. figs. 20-22).—A subspecies of G. japonica, Pfr.

—— ferruginea, Pilsbry (I. p. 529, pl. xxi. figs. 14-16).

—— heteroglypta, Pilsbry (1. p. 529, pl. xxi. figs. 17–19).—Probably a subspecies of G. japonica, Pfr.

Eulota (Plectotropis) Hirasei, Gude (11. p. 10, pl. ii. figs. 4-7).—A synonym of E. cavicollis, Pils.

--- (Ægista) awajiensis, Gude (11. p. 11, pl. ii. figs. 8-10).—A synonym of E. aperta, Pils.

— horrida, Pilsbry (III. p. 11).

—— (Trishoplita?) mesogonia, Pilsbry (III. p. 11).—Doubtless a Trishoplita.

Ganesella Jacobii, Pilsbry (III. p. 12). Cyclotus (?) micron, Pilsbry (III. p. 12).

Pomatiopsis Hirasei, Pilsbry (111. p. 12).—This is Blanfordia Bensoni, A. Ad. The genus belongs to the Pomatiopsinæ.

Buliminus Hirasei, Pilsbry (IV. p. 32).

— callistoderma, Pilsbry (IV. p. 33).

Plectotropis polyplecta, Ehrmann (v. p. 379).—A synonym for Eulota horrida, Pils.

—— delectabilis, Ehrmann (v. p. 380).

—— pachysoma, Ehrmann (v. p. 380).—Seems to be identical with Eulota scepasma, Pfr.

Trishoplita pallens, Ehrmann (v. p. 381). Ganesella pagodula, Ehrmann (v. p. 381).

Clausilia (Phædusa) crassilamellata, Ehrmann (v. p. 382).

—— (——) ijimæ, Ehrmann (v. p. 382). —— (——) cincticollis, Ehrmann (v. p. 383). Alyœus harimensis, Pilsbry (vi. p. 381).

—— Reinhardti, Pilsbry (vi. p. 381).

— (Metalycœus) melanopoma, Pilsbry (vi. p. 382).

—— (——) Hirasei, Pilsbry (vi. p. 382).

Diplommatina pusilla, var. omiensis, Pilsbry (vi. p. 382).

Macrochlamys micrograpta, Pilsbry (vi. p. 382).—The locality, Kashima, prov. Harima, was inadvertently omitted.

Kaliella multivolvis, Pilsbry (vi. p. 383).

Vitrea harimensis, Pilsbry (vi. p. 384).—Seems to be the young of Macrochlamys Denitzi, Reinh.

Georissa japonica, Pilsbry (vi. p. 384).

Chloritis (Trichochloritis) fragilis, Gude (vii. p. 70, pl. viii. figs. 18-

20).—This species is related to C. oscitans, v. Mart., which

has hitherto been referred to Acusta.

Eulota (Plectotropis) amula, Gude (vii. p. 71, pl. viii. figs. 9-11).—
This is H. conella, A. Ad., 1868, as defined by von Martens,
Conch. Mittheil. pl. xviii. figs. 8-12. Not H. conella, Pfr.,
1861.

—— (Euhadra) sericea, Gude (VII. p. 74, pl. viii. figs. 12-14).—
This is the true E. Blakeana, Newc., of which I have examined the types.

Macrochlamys fulgens, Gude (VII. p. 75, pl. viii. figs. 24-26).

Arnouldia nahaensis, Gude (vii. p. 75, pl. viii. figs. 21-23).—Belongs to the genus Kaliella.

Crystallus sulcatus, Gude (XII. p. 399).

---- velatus, Gude (XII. p. 399).

Microcystis Hirasei, Gude (XII. p. 400).—A synonym of Macrochlamys micrograpta, Pils.

Trishoplita cretacea, Gude (xII. p. 400). Plectotropis conica, Gude (XII. p. 400).

Blanfordia japonica, "A. Ad.," Möllendorff (XIII. p. 153).—This is B. Bensoni, var. minor, Pils., not the true B. japonica, A. Ad., which was described in this Journal.

Kaliella elata, Gude (xiv. p. 453).—This seems to be a variety of Situla circumcincta, Reinh.

---- crenulata, Gude (xiv. p. 453).

—— pagoduloides, Gude (XIV. p. 453). Pyramidula pretiosa, Gude (XIV. p. 454).

Trishoplita dacostæ, Gude (xiv. p. 454).

--- tosana, Gude (xiv. p. 455).

Eulota (Euhadra) grata, Gude (xiv. p. 455).—With var. zonata, Gude, t. c. p. 456.

—— (Plectotropis) kiusiuensis, Pilsbry (xv. p. 79).

Trishoplita Goodwini, var. suprazonata, Pilsbry (xv. p. 80).—A synonym of T. tosana, Gude, published three days earlier.

Ganesella turrita, Gude (vii. p. 75, pl. viii. figs. 1, 2).—Probably, as Mr. Gude suggests, a species of Buliminopsis.

Eulota (Plectotropis) lepidophora, Gude (VII. p. 76, pl. viii, figs. 3-5).

—— (——) ——, var. tenuis, Gude (l. c.).

Satsuma brunnea, Möllendorff (viii. p. 107).—Probably identical with Ganesella ferruginea, Pils.

Euhadra luhuana, subsp. tsushimana, Möllendorff (viii. p. 108).

Buliminus rugulosus, Möllendorff (viii. p. 108).

Clausilia (Euphædusa) oncauchen, Möllendorff (viii. p. 109).

Pupinella Fruhstorferi, Möllendorff (viii. p. 110), with var. tsushimana.—Scarcely distinct from P. rufa.

Clausilia hakonensis, Pilsbry (1x. p. 443, pl. xiv. figs. 1-3).
—— awajiensis, Pilsbry (1x. p. 444, pl. xiv. figs. 15-17).

— aulacophora, Pilsbry (1x. p. 445, pl. xiv. figs. 18-20).

—— Hirasei, Pilsbry (IX. p. 446, pl. xiv. figs. 8-11).

Clausilia hyperoptyx, Pilsbry (IX. p. 446, pl. xiv. figs. 12-14).

—— japonica, var. surugæ, Pilsbry (xx. p. 447, pl. xiv. fig. 4).—
Seems to me to = Cl. oostoma, Mlldff. Cf. Cl. eurystoma, var. brachuntucha, below.

brachyptycha, below.

Eulota Gudeana, Pilsbry (x. p. 60).—Probably a subspecies of
E. Gainesi, Pils.

—— callizona Dixoni, Pilsbry (x. p. 60).

Arnouldia ceratodes, Gude (xii. p. 398).—Very closely related to Microcystina labilis, Gld., but smaller and more polished. It seems to be a Microcystina.

nanodes, Gude (XII. p. 399).—The generic position of this and the two species following is doubtful. I have seen none of

them.

Kaliella symmetrica, Pilsbry (xv. p. 80).—A synonym of K. pagoduloides, Gude, which was published three days earlier.

--- fraterna, Pilsbry (xv. p. 81).

Euconulus Reinhardti, Pilsbry (xv. p. 81).-A Kaliella.

Punctum japonicum, Pilsbry (xv. p. 82).

Diplommatina uzenensis, Pilsbry (xvi. p. 88).

Eulota callizona, var. maritima, Gulick & Pilsbry (xvi. p. 88).

—— luhuana, var. idzumonis, Pilsbry & Gulick (xvi. p. 89). ———, var. aomoriensis, Gulick & Pilsbry (xvi. p. 89).

Trishoplita Goodwini, var. kyotoensis, Pilsbry (xvi. p. 90).

Eulota mercatoria, var. atrata, Pilsbry (xvi. p. 91).

Clausilia comes, Pilsbry (xvii. p. 673, pl. xxiv. figs. 1-3).
— monelasmus, Pilsbry (xvii. p. 674, pl. xxiv. figs. 4-6).

—— iotaptyx, Pilsbry (xvII. p. 674, pl. xxiv. figs. 7-9). —— mikado, Pilsbry (xvII. p. 676, pl. xxiv. figs. 10-12).

— brevior, var. Addisoni, Pilsbry (xvII. p. 677).

—— hondana, Pilsbry (xvII. p. 677, pl. xxiv. figs. 13-18).

---- subjaponica, Pilsbry (xvII. p. 678).

—— Nolani, Pilsbry (xvII. p. 679, pl. xxv. figs. 19-21).
—— tosana, Pilsby (xvII. p. 680, pl. xxv. figs. 22-25, 41).
—— shikokuensis, Pilsbry (xvII. p. 681, pl. xxv. figs. 30-32).

Eulota (Ægista) mimula, Pilsbry (xvIII. p. 107).

Trishoplita cretacea, var. bipartita, Pilsbry (XVIII. p. 107).

Eulota (Plectotropis) elegantissima, var. cara, Pilsbry (xvIII. p. 107). Clausilia euholostoma, Pilsbry (xvIII. p. 108).

— japonica, var. interplicata, Pilsbry (xvIII. p. 108).

—— perpallida, Pilsbry (xvIII. p. 108). —— harimensis, Pilsbry (xvIII. p. 108).

—— hokkaidoensis, Pilsbry (xviii. p. 108).—This seems to be a subspecies of C. perpallida of Hondo Island.

— iotaptyx, var. clava (xviii. p. 108). — Hiraseana, Pilsbry (xix. p. 115).

Trishoplita Smithiana, Pilsbry (xix. p. 116).

Ganesella myomphala, var. omphalodes, Pilsbry (xix. p. 116).

Ganesella Wiegmanniana, Pilsbry (xix. p. 116).

Helicina osumiensis, Pilsbry (xx. p. 127).

- Reinii, var. uzenensis, Pilsbry (xx. p. 128).

Vertigo Hirasei, Pilsbry (xx. p. 128).

Buliminus callistoderma, var. ogasawaræ, Pilsbry (xx. p. 128).

—— eucharistus, Pilsbry (xx. p. 128). — luchuanus, Pilsbry (xx. p. 129).

Eulota (Ægista) Martensiana, Pilsbry (xx. p. 129).

- (Plectotropis) inornata, Pilsbry (xx. p. 129).

Gastrodontella japonica, Möllendorff (XXI. p. 38).—A synonym of Kaliella multivolvis, Pils.

Buliminus (Subzebrinus) nipponicus, Möllendorff (xx. p. 40).—A

synonym of B. Hirasei, Pils.

Clausilia (Stereophædusa) eurystoma, snbsp. brachyptycha, Möllendorff (xx. p. 41).—This is C. japonica, var. surugæ, Pils., which I subsequently (XVII. p. 677) thought to be C. oostoma, Mlldff.

— (Megalophædusa) Fultoni, subsp. clavula, Möllendorff (xx. p. 41). = C. subjaponica, Pilsbry \*.

- (Hemiphædusa) breviluna, Möllendorff (xx. p. 42). = C. aula-

cophora, Pilsbry. \_ (\_\_\_\_) omiensis, Möllendorff (xx. p. 42). = C. mikado, Pils. Diplommatina (Sinica) minutissima, Möllendorff (xx. p. 44). = D.

pusilla, var. omiensis, Pilsbry. Georissa japonica, Möllendorff (xx. p. 45).—This seems to be

G. japonica, Pilsbry.

Succinea ogasawaræ, Pilsbry (XXI. p. 195). — punctulispira, Pilsbry (xxi. p. 195).

Total, 129 new species and varieties, of which 22 are known to be absolute synonyms, while perhaps a half-dozen more are doubtfully distinct.

## Bibliography.

[Note.—For publications prior to 1900 see Gude's papers II. and VII.]

I.—" Additions to the Japanese Land-Snail Fauna," by H. A. Pilsbry. Proc. Acad. Nat. Sci. Philad. for 1899, pp. 525-530, pl. xxi. (Issued February 12, 1900.)

II.-" Notes on a Collection of Helicoid Land-Shells from Japan and the Loo Choo Islands, with Descriptions of Two new Species of Helicidæ," by G. K. Gude. Proc. Malac. Soc. London, iv. pp. 8-23, pl. ii. (Issued late in March 1900. My copy was received in Philadelphia, April 12.)

111.—"Notices of some new Japanese Mollusks," by H. A. Pilsbry. Nautilus, xiv. pp. 11, 12. (Issued May 1, 1900.)

11v.—Ditto. Nautilus, xiv. pp. 32, 33. (Issued July 1, 1900.)

\* The clausilium of C. subjaponica is strongly curved distally and much thickened at the apex. In C. Fultoni, as in C. vasta, it is not much curved distally, and is not thickened at the apex. I therefore believe the species to belong to the section Stereophædusa, and not to Megalophædusa. v.—"Diagnosen einiger neuer japanischer Landschnecken," von Paul Ehrmann. Zool. Anzeiger, xxiii. no. 619, pp. 379-383. (Issued July 9, 1900.)

VI.—"Notices of new Japanese Land-Snails," by H. A. Pilsbry. Proc. Acad. Nat. Sci. Philad. for 1900, pp. 381-384. (Issued August 9,

1900.)

VII.—"Further Notes on Helicoid Land-Shells from Japan, the Loo Choo and Bonin Islands, with Descriptions of Seven new Species." by G. K. Gude. Proc. Malac. Soc. London, iv. pp. 70-80, pl. viii. (Issued August 1900.)

VIII.—"Landschnecken von den Inseln Tsushima und Iki, Westjapan,"

von Dr. O. v. Möllendorff. Nachrbl. d. deutschen malak. Ges. xxxii. nos. 7, 8, pp. 107-111. (Issued August 1900.)
IX.—"Additions to the Japanese Land-Snail Fauna, II.," by Henry A. Pilsbry. Proc. Acad. Nat. Sci. Philad. for 1900, pp. 443-448, pl. xiv. (Issued August 29, 1900.)
x.—"On some Japanese Land-Snails," by H. A. Pilsbry. Nautilus, xiv. pp. 59, 60. (Issued Sept. 1, 1900.)
xx.—"Mollusques de l'Archipel de Bonin," par M. C. F. Ancey.

Journal de Conchyliologie, xlviii. no. 3, pp. 423-428.

XII.—" Descriptions of new Species of Japanese Land-Shells," by G. K. Gude. Ann. & Mag. Nat. Hist. (7) vi. pp. 398-401. (Issued Oct. 1, 1900.)

xIII.—" Blanfordia, A. Ad.," von Dr. O. v. Möllendorff. Nachrbl. der

deutschen malak. Ges. xxxii. pp. 153, 154. (October 1900.) xiv.—" Descriptions of new Species of Japanese Land-Shells," by G. K. Gude. Ann. & Mag. Nat. Hist. (7) vi. pp. 453-456. (Issued Nov. 1, 1900.)

xv.—" New Species of Japanese Land-Mollusca," by H. A. Pilsbry,

Nautilus, xiv. pp. 79-82. (Issued Nov. 3, 1900.) xvi.—"Descriptions of new Japanese Land-Snails," by H. A. Pilsbry and Addison Gulick. Nautilus, xiv. pp. 88-91. (Issued Dec. 1, 1900.)

xvII.—"Additions to the Japanese Land-Snail Fauna, III.," by Henry A. Pilsbry. Proc. Acad. Nat. Sci. Philad. for 1900, pp. 672-683, pls. xxiv., xxv. (Pages 672–676 issued Dec. 29, 1900; pp. 677–683 issued Jan. 28, 1901.)

XVIII.—" Notices of some new Japanese Land-Snails," by H. A.

Pilsbry. Nautilus, xiv. pp. 107, 108. (Issued Jan. 1, 1901.) xix.—" Notices of some new Japanese Land-Snails," by H. A. Pilsbry. Nautilus, xiv. pp. 115-117. (Issued Feb. 1, 1901.) xx.—"Notices of new Japanese Land-Snails," by H. A. Pilsbry. Nau-

tilus, xiv. pp. 127-129. (Issued March 1, 1901.)

xxi.—"Neue und kritische Landschnecken von Japan und den
Liukiu-Inseln," von Dr. O. von Möllendorff. Nachrbl. der deutschen malak. Gesellschaft, nos. 3, 4, 1901. (Issued in April

xxII.—"New Mollusca from Japan, the Loo Choo Islands, Formosa, and the Philippines," by Henry A. Pilsbry. Proc. Acad. Nat. Sci. Philad. for 1901; terrestrial species on pp. 193-195. (Issued

May 2, 1901.)